CLAIMS

What is claimed is:

5 1.   A magnetic memory cell comprising:

a first magnetic tunneling junction including a first ferromagnetic layer, a second

ferromagnetic layer and a first insulating layer between the first ferromagnetic layer and the

second ferromagnetic layer;

a reference magnetic tunneling junction including a third ferromagnetic layer, a

10 fourth ferromagnetic layer and a second insulating layer between the third ferromagnetic

layer and the fourth ferromagnetic layer; and

means, coupled with the first magnetic tunneling junction and the reference magnetic

tunneling junction, for comparing a first output of the first magnetic tunneling junction with

a reference output of the reference magnetic tunneling junction.

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2.   The magnetic memory cell of claim 1 wherein the comparing means further

includes an operational amplifier having a first input and a second input, the first input being

coupled with the first magnetic tunneling junction, the second input being coupled with the

reference magnetic tunneling junction.

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3.   The magnetic memory cell of claim 1 further comprising:

a first current source coupled with the first magnetic tunneling junction; and

a second current source coupled with the reference magnetic tunneling junction.

4.   The magnetic memory cell of claim 1 further comprising:

at least one write circuit coupled with the first magnetic tunneling junction and the reference magnetic tunneling junction.

5   5.   A magnetic memory unit comprising:

a plurality of magnetic tunneling junctions for storing data, each of the plurality of magnetic tunneling junctions including a first ferromagnetic layer, a second ferromagnetic layer and a first insulating layer between the first ferromagnetic layer and the second ferromagnetic layer;

10   a reference magnetic tunneling junction including a third ferromagnetic layer, a fourth ferromagnetic layer and a second insulating layer between the third ferromagnetic layer and the fourth ferromagnetic layer; and

means, coupled with the plurality of magnetic tunneling junctions and the reference magnetic tunneling junction, for comparing a plurality of outputs of the plurality of

15   magnetic tunneling junctions with a reference output of the reference magnetic tunneling junction.

6.   The magnetic memory unit of claim 5 wherein the comparing means further includes a plurality of operational amplifiers, each of the plurality of operational amplifiers

20   having a first input and a second input, the first input being coupled with a magnetic tunneling junction of the plurality of magnetic tunneling junctions, the second input being coupled with the reference magnetic tunneling junction.

7.   The magnetic memory unit of claim 5 further comprising:

a plurality of current sources, a current source of the plurality of current source coupled with a corresponding magnetic tunneling junction of the plurality of magnetic tunneling junctions, and with the reference magnetic tunneling junction.

8.   The magnetic memory unit of claim 5 further comprising:

at plurality of write circuits coupled with the plurality of magnetic tunneling junctions and with the reference magnetic tunneling junction.

9.   The magnetic memory unit of claim 5 wherein the plurality of magnetic tunneling junctions includes six magnetic tunneling junctions and wherein the magnetic memory is capable of storing eight bits.

10.   The magnetic memory unit of claim 5 wherein the plurality of magnetic tunneling junctions includes eleven magnetic tunneling junctions and wherein the magnetic memory unit is capable of storing sixteen bits.

11.   The magnetic memory unit of claim 5 wherein the magnetic memory unit is part of a magnetic random access memory.

12.   A method for using a magnetic memory cell comprising the steps of:

(a)   programming a first magnetic tunneling junction, the first magnetic tunneling junction including a first ferromagnetic layer, a second ferromagnetic layer and a first insulating layer between the first ferromagnetic layer and the second ferromagnetic layer;

(b)   programming a reference magnetic tunneling junction including a third

ferromagnetic layer, a fourth ferromagnetic layer and a second insulating layer between the

third ferromagnetic layer and the fourth ferromagnetic layer; and

(c)   comparing a first output of the first magnetic tunneling junction with a

5   reference output of the reference magnetic tunneling junction.